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Terms	Documents
L13 and NF	0

Database: US Patents Full-Text Database
US Pre-Grant Publication Full-Text Database
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Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT; PLUR=YES; OP=ADJ			
L14	L13 and NF	0	L14
L13	permeate same xylose and membrane	20	L13
L12	L11 and nanofiltration	0	L12
L11	L8 and xylose same permeate	2	L11
L10	L8 and Desal-5	0	L10
L9	L8 and nf-200	0	L9
L8	xylose and biomass and membrane	248	L8
L7	L6 and biomass same hydrolysate	1	L7
L6	nanofiltration and xylose	12	L6
L5	L4 and nanofiltration and xylose	1	L5
L4	((210/652)!.CCLS.)	435	L4
L3	L2 and nanofiltration	3	L3
L2	L1 and xylose	7	L2
L1	((210/651)!.CCLS.)	950	L1

END OF SEARCH HISTORY

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Terms	Documents
L6 and biomass same hydrolysate	1

Database: US Patents Full-Text Database
US Pre-Grant Publication Full-Text Database
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Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L7

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Search History

DATE: Tuesday, September 02, 2003 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT; PLUR=YES; OP=ADJ			
L7	L6 and biomass same hydrolysate	1	L7
L6	nanofiltration and xylose	12	L6
L5	L4 and nanofiltration and xylose	1	L5
L4	((210/652)!.CCLS.)	435	L4
L3	L2 and nanofiltration	3	L3
L2	L1 and xylose	7	L2
L1	((210/651)!.CCLS.)	950	L1

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Search Results - Record(s) 1 through 2 of 2 returned.

1. Document ID: US 5324442 A

L11: Entry 1 of 2 File: USPT Jun 28, 1994

US-PAT-NO: 5324442
DOCUMENT-IDENTIFIER: US 5324442 A

TITLE: Fermentation process for the production of calcium magnesium road deicer

DATE-ISSUED: June 28, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mathews; Alexander P.	Manhattan	KS		

US-CL-CURRENT: 252/70; 427/220, 428/403

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw Desc | Image

2. Document ID: US 4771001 A

L11: Entry 2 of 2 File: USPT Sep 13, 1988

US-PAT-NO: 4771001
DOCUMENT-IDENTIFIER: US 4771001 A

TITLE: Production of lactic acid by continuous fermentation using an inexpensive raw material and a simplified method of lactic acid purification

DATE-ISSUED: September 13, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bailey; Richard B.	Cupertino	CA		
Joshi; Dilip K.	Kalamazoo	MI		
Michaels; Stephen L.	Newton	MA		
Wisdom; Richard A.	Foster City	CA		

US-CL-CURRENT: 435/139; 426/41, 426/43, 435/813, 435/853, 435/854, 435/856, 435/885, 562/589

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
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Search Results - Record(s) 1 through 3 of 3 returned.

☐ 1. Document ID: US 6329182 B1

L3: Entry 1 of 3 File: USPT Dec 11, 2001

US-PAT-NO: 6329182
DOCUMENT-IDENTIFIER: US 6329182 B1

TITLE: Method of producing oligosaccharide syrups, a system for producing the same and oligosaccharide syrups

DATE-ISSUED: December 11, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pedersen; Sven	Gentofte			DK
Hendriksen; Hanne Vang	Holte			DK

US-CL-CURRENT: 435/96; 127/55, 210/651, 210/652, 210/654, 435/100, 435/95, 435/99

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 2. Document ID: US 5681728 A

L3: Entry 2 of 3 File: USPT Oct 28, 1997

US-PAT-NO: 5681728
DOCUMENT-IDENTIFIER: US 5681728 A

TITLE: Method and apparatus for the recovery and purification of organic acids

DATE-ISSUED: October 28, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Miao; Fudu	Louisville	CO		

US-CL-CURRENT: 435/136; 204/519, 204/522, 204/527, 204/530, 204/534, 204/536, 204/537, 204/630, 204/637, 204/638, 210/259, 210/651, 210/654, 435/137, 435/140, 435/800, 562/486, 562/580, 562/589, 562/593

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 3. Document ID: US 5503750 A

L3: Entry 3 of 3 File: USPT Apr 2, 1996

US-PAT-NO: 5503750
DOCUMENT-IDENTIFIER: US 5503750 A

TITLE: Membrane-based process for the recovery of lactic acid by fermentation of carbohydrate substrates containing sugars

DATE-ISSUED: April 2, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Russo, Jr.; Lawrence J.	Mishawaka	IN	46545	
Kim; Hyung S.	Osceola	IN	46561	

US-CL-CURRENT: 210/641; 210/259, 210/651

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Search Results - Record(s) 1 through 3 of 3 returned.

☐ 1. Document ID: US 6329182 B1

L3: Entry 1 of 3 File: USPT Dec 11, 2001

US-PAT-NO: 6329182
DOCUMENT-IDENTIFIER: US 6329182 B1

TITLE: Method of producing oligosaccharide syrups, a system for producing the same and oligosaccharide syrups

DATE-ISSUED: December 11, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pedersen; Sven	Gentofte			DK
Hendriksen; Hanne Vang	Holte			DK

US-CL-CURRENT: 435/96; 127/55, 210/651, 210/652, 210/654, 435/100, 435/95, 435/99

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 2. Document ID: US 5681728 A

L3: Entry 2 of 3 File: USPT Oct 28, 1997

US-PAT-NO: 5681728
DOCUMENT-IDENTIFIER: US 5681728 A

TITLE: Method and apparatus for the recovery and purification of organic acids

DATE-ISSUED: October 28, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Miao; Fudu	Louisville	CO		

US-CL-CURRENT: 435/136; 204/519, 204/522, 204/527, 204/530, 204/534, 204/536, 204/537, 204/630, 204/637, 204/638, 210/259, 210/651, 210/654, 435/137, 435/140, 435/800, 562/486, 562/580, 562/589, 562/593

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 3. Document ID: US 5503750 A

L3: Entry 3 of 3 File: USPT Apr 2, 1996

US-PAT-NO: 5503750
DOCUMENT-IDENTIFIER: US 5503750 A

TITLE: Membrane-based process for the recovery of lactic acid by fermentation of carbohydrate substrates containing sugars

DATE-ISSUED: April 2, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Russo, Jr.; Lawrence J.	Mishawaka	IN	46545	
Kim; Hyung S.	Osceola	IN	46561	

US-CL-CURRENT: 210/641; 210/259, 210/651

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Search Results - Record(s) 1 through 7 of 7 returned.

☐ 1. Document ID: US 6329182 B1

L2: Entry 1 of 7 File: USPT Dec 11, 2001

US-PAT-NO: 6329182
DOCUMENT-IDENTIFIER: US 6329182 B1

TITLE: Method of producing oligosaccharide syrups, a system for producing the same and oligosaccharide syrups

DATE-ISSUED: December 11, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pedersen; Sven	Gentofte			DK
Hendriksen; Hanne Vang	Holte			DK

US-CL-CURRENT: 435/96; 127/55, 210/651, 210/652, 210/654, 435/100, 435/95, 435/99

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

☐ 2. Document ID: US 5755967 A

L2: Entry 2 of 7 File: USPT May 26, 1998

US-PAT-NO: 5755967
DOCUMENT-IDENTIFIER: US 5755967 A

TITLE: Silicalite membrane and method for the selective recovery and concentration of acetone and butanol from model ABE solutions and fermentation broth

DATE-ISSUED: May 26, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Meagher; Michael M.	Lincoln	NE	68506	
Qureshi; Nasibuddin	Lincoln	NE	68503	
Hutkins; Robert	Lincoln	NE	68502	

US-CL-CURRENT: 210/640; 210/500.25, 210/651

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 3. Document ID: US 5681728 A

L2: Entry 3 of 7 File: USPT Oct 28, 1997

US-PAT-NO: 5681728
DOCUMENT-IDENTIFIER: US 5681728 A

TITLE: Method and apparatus for the recovery and purification of organic acids

DATE-ISSUED: October 28, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Miao; Fudu	Louisville	CO		

US-CL-CURRENT: 435/136; 204/519, 204/522, 204/527, 204/530, 204/534, 204/536, 204/537, 204/630, 204/637, 204/638, 210/259, 210/651, 210/654, 435/137, 435/140, 435/800, 562/486, 562/580, 562/589, 562/593

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw Desc | Image

☐ 4. Document ID: US 5503750 A

L2: Entry 4 of 7 File: USPT Apr 2, 1996

US-PAT-NO: 5503750
DOCUMENT-IDENTIFIER: US 5503750 A

TITLE: Membrane-based process for the recovery of lactic acid by fermentation of carbohydrate substrates containing sugars

DATE-ISSUED: April 2, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Russo, Jr.; Lawrence J.	Mishawaka	IN	46545	
Kim; Hyung S.	Osceola	IN	46561	

US-CL-CURRENT: 210/641; 210/259, 210/651

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
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☐ 5. Document ID: US 5078888 A

L2: Entry 5 of 7 File: USPT Jan 7, 1992

US-PAT-NO: 5078888
DOCUMENT-IDENTIFIER: US 5078888 A

TITLE: Method for processing aqueous fermentation broths

DATE-ISSUED: January 7, 1992

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Penticoff; Amy M.	Midland	MI		
Lyon; John D.	Midland	MI		

US-CL-CURRENT: 210/639; 210/651

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
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☐ 6. Document ID: US 5008189 A

L2: Entry 6 of 7 File: USPT Apr 16, 1991

US-PAT-NO: 5008189
DOCUMENT-IDENTIFIER: US 5008189 A

TITLE: Enhanced membrane separation of monosaccharides utilizing concentration polarization

DATE-ISSUED: April 16, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Oroskar; Anil R.	Downers Grove	IL		
Johnson; James L.	Des Plaines	IL		

US-CL-CURRENT: 435/105; 127/55, 210/651, 210/654, 435/205, 435/262, 435/280, 435/803, 435/96

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
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☐ 7. Document ID: US 4728393 A

L2: Entry 7 of 7 File: USPT Mar 1, 1988

US-PAT-NO: 4728393
DOCUMENT-IDENTIFIER: US 4728393 A

TITLE: Methods for obtaining deicers from black liquor

DATE-ISSUED: March 1, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Peel; Terence E.	Quebec			CA

US-CL-CURRENT: 162/29; 162/16, 162/31, 162/35, 210/651, 252/70, 530/500

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
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L8 and xylose same permeate	2

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L7: Entry 1 of 1 File: USPT Jun 25, 2002

DOCUMENT-IDENTIFIER: US 6409841 B1
TITLE: Process for the production of organic products from diverse biomass sources

Detailed Description Text (17):
Stage 1 of this embodiment involves dilute acid hydrolysis of the pre-treated biomass feedstock. Exemplary conditions for this hydrolysis are about 0.4% HNO.sub.3, at about 195.degree. C. for about 5 minutes in a saturated steam environment within a pressure reactor such as is commonly employed in the pulping industry. Stage 1 is preferably terminated by rapid pressure release (steam explosion) and will solubilize and liberate about one-third of the material of the feedstock. The liquid hydrolysate and solids are then washed and pressed.

Detailed Description Text (18):
Following the Stage 1 dilute acid hydrolysis, a first product separation and recovery is conducted. The Stage 1 liquid hydrolysate is washed and pressed repeatedly from the residual solids to recover about 95% of the liberated sugars, polysaccharide fragments and coproduct volatile organic compounds-such as acetic acid, furfural and hydroxymethylfurfural. The resulting press liquid comprising nominally six times the biomass feed contains solubilized product in about 5% concentration. The liquid is conveyed to a reservoir from which it is passed through nanofiltration (NF) membranes with a standard molecular weight cutoff designed to concentrate and contain the sugars. The concentrated retentate from the NF separation contains the free sugars at nominally 20% concentration and polysaccharide fragments, which are conveyed to the Stage 4 bacterial fermentation process, to be described. The NF permeate contains volatile organics, along with dilute acid catalyst. Importantly, the economics of the process may be enhanced by recycling the permeate back through the Stage 1 wash cycles in successive iterations of the process, conserving acid and accumulating and concentrating VOC coproducts prior to their recovery.

Detailed Description Text (21):
Following the Stage 2 dilute acid hydrolysis, a further product separation and recovery is conducted. The Stage 2 liquid hydrolysate is washed and pressed repeatedly from the residual solids to recover about 95% of the liberated sugars, oligosaccharide fragments, acid and additional coproduct volatile organic compounds--such as hydroxymethylfurfural. As in Stage 1, the resulting press liquid is conveyed to a reservoir from which it is passed through nanofiltration (NF) membranes. The concentrated retentate from the NF separation contains the free sugars at nominally 20% concentration and polysaccharide and oligosaccharide fragments, which together are conveyed to the Stage 4 bacterial fermentation process, to be described.

Detailed Description Text (22):
Through the nanofiltration process on the Stage 1 and 2 hydrolysates separation of the depolymerized sugar and oligosaccharide (polymer fragment) from the stream of the process is facilitated. The aqueous permeate of nanofiltration is effectively reconcentrated by vacuum distillation for recycling the acid catalyst to the hydrolysis process stages. Importantly, the reconcentrated catalyst will also be recognized to contain the solubilized fraction of volatile organic chemicals that are liberated by the hydrolysis process in approximately 5% concentration weight/weight at each step of the biomass processing. Thus, after several steps of

processing, recovering and concentrating the catalyst carrier and VOCs, a substantial accumulation of VOC products is effected in the catalyst. When this accumulation is judged cost effective to recover, the VOCs may be extracted by fractional distillation, as noted above.

Detailed Description Text (35):
Stages 4 and 5 of the process, bacterial fermentation of sugars, also takes place in a continuous recycle reactor comprised of vessels containing separately or jointly provision of biocatalytic agents for fermenting both the five- and six-carbon sugars liberated in Stages 1, 2 and 3 of the process. The practice of Stages 4 and 5 is distinct from prior art in biomass ethanol technology in achieving very high yield with large gains in productivity in both time and tankage realized by: 1) implementing a continuous-flow reactor with feedstock replenishment and product extraction, while 2) employing microfiltration to retain biocatalyst in the reactor to speed the process and 3) optionally making provision for product extracting dilution water to control end-product inhibition in the fermentation process. In the case of the continuously fed SSF enzyme recycle reactor, a nanofiltration membrane can be used to retain catalyst and concentrated sugars in the reactor, while passing residual aqueous carrier.

Detailed Description Text (40):
A major objective of the invention is to build broad flexibility into lignocellulostic biomass processes with regard to value adding product diversity, while maintaining energy efficiency and clean, functional consistency in the face of the fact that many chemical products and coproducts of interest, such as the volatile organic components of the hydrolysate, will have boiling points greater than that of water. Indeed, these coproducts typically pose potential product yield of 17% and product revenues exceeding 20% against the major product, e.g., ethanol, from sugar fermentation, but would imply several times more energy to first boil off all the water for their recovery by traditional distillation. Moreover, it will be appreciated that, while ethanol is a major product opportunity of a process in accordance with the present invention, the design of the processes that explicitly makes concentrated sugars readily accessible alternatively, facilitates both a variety of sugar-based products such as beverages, foods and feed, and through the available agency of a spectrum of different fermentation organisms, a host of alternative chemical products other than ethanol. Such will be recognized to prominently include a number of important organic acids. Accordingly, in the product separation and extraction portions of the process applied to recovery of volatile organic chemicals, including ethanol, efficient solvent extraction may alternatively be invoked to enable product recovery and separation from a higher boiling point medium.

Detailed Description Text (49):
Following the Stage 1 dilute acid hydrolysis, the first instance of Stage 5 product separation is conducted. The Stage 1 liquid hydrolysate is washed and pressed repeatedly from the residual solids to recover about 95% of the liberated sugars, polysaccharide fragments and coproduct volatile organic compounds--such as acetic acid, furfural and hydroxymethylfurfural. The resulting press liquid comprising nominally six times the biomass feed contains solubilized product in about 5% concentration. The liquid is conveyed to a reservoir from which it is sequentially passed through microfiltration membranes as in the first embodiment. The retentate from the NF separation contains sugars and polysaccharide fragments which are conveyed to the Stage 4 fermentation process as in Embodiment 1. The NF permeate, which contains the residual acid and volatile organics, is then recycled in the wash to concentrate and accumulate the VOCs through successive iterations of the process prior to accumulated product recovey by fractional distillation. The sugars are concentrated to order 20% for efficient fermentation in Stage 4, to be described.

Detailed Description Text (74):
The tests in question involve two-stage dilute acid hydrolysis by Brink using nitric acid and single-stage dilute acid hydrolysis of Nguyen using sulfuric acid. Both acids are similarly efficacious from a hydrolysis standpoint. The two-stage approach is founded in the understanding first that hemicellulose is more readily hydrolyzed under milder conditions of pressure, temperature and acid concentration than cellulose. Second, glucose (derived principally from cellulose) is more resistant to

chemical degradation after depolymerization than xylose, the principal product of hemicellulose.

CLAIMS:

29. The method of claim 27, further comprising treating washed and pressed product of the first and second acid hydrolysis stages by nanofiltration to concentrate and separate free sugars and oligonucleotide fragments for subsequent fermentation, and enable the vacuum evaporative concentration of residual acid catalyst and accumulated volatile organic compounds through iterations of the process.

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L3: Entry 1 of 3 File: USPT Dec 11, 2001

DOCUMENT-IDENTIFIER: US 6329182 B1
TITLE: Method of producing oligosaccharide syrups, a system for producing the same and oligosaccharide syrups

Abstract Text (1):
The present invention relates to a method of producing oligosaccharide syrups, in particular to the production of syrups having a high concentration of saccharides with a degree of polymerization of at least 2, comprising the steps of: enzymatic reaction of a substrate at a temperature in the range of 50.degree. C. to 100.degree. C. obtaining a saccharide solution comprising monosaccharides and disaccharides, trisaccharides and higher saccharides; nanofiltration of the saccharide solution at a temperature in the range of 60.degree. C. to 100.degree. C. obtaining a syrup essentially comprising disaccharides, trisaccharides and higher saccharides; recovering said syrup; optionally recycling the permeate resulting from the nanofiltration step to the enzymatic reaction.

Brief Summary Text (14):
nanofiltration of the saccharide solution at a temperature in the range of 60.degree. C. to 100.degree. C. obtaining a syrup essentially comprising disaccharides, trisaccharides and higher saccharides,

Brief Summary Text (16):
optionally recycling the permeate resulting from the nanofiltration step to the enzymatic reaction, whereby it is possible to obtain an oligosaccharide syrup having a high content of saccharides of a degree of polymerisation of at least 2.

Brief Summary Text (17):
The permeate comprising monosaccharides may be used as substrate for the enzymatic reaction saving a considerable amount of substrate and reducing the total costs involved in the method. In a continuous method, this can be achieved by recycling the permeate material to the enzyme reactor directly by having a direct passage to the enzyme reactor from the nanofiltration unit. Alternative, the permeate may be stored for later use.

Brief Summary Text (20):
means for passing saccharide solution from the reactor outlet(s) to at least one nanofiltration unit,

Brief Summary Text (21):
at least one nanofiltration unit having a nanofiltration membrane dividing the nanofiltration unit into an entrance side having at least one inlet and at least one outlet, and an exit side having at least one outlet, and having means for controlling the pressure applied to the membrane,

Brief Summary Text (22):
optionally means for recycling material from an outlet of the exit side of the nanofiltration unit to the enzyme reactor.

Brief Summary Text (27):
nanofiltration of the saccharide solution at a temperature in the range of 60.degree. C. to 80.degree. C. obtaining a syrup essentially comprising disaccharides, trisaccharides and higher saccharides,

Brief Summary Text (29):
recovering the permeate resulting from the nanofiltration step.

Drawing Description Text (5):
FIG. 3 is a presentation of another embodiment of the system according to the invention wherein the enzyme reactor is connected to three nanofiltration units arranged in parallel.

Detailed Description Text (4):
Typically, the substrate is constituted by one type of monosaccharide only, for example glucose, fructose, galactose, UDP-galactose, mannose, or xylose. However, in some embodiments the substrate may be a mixture of at least two different monosaccharides, such as glucose and fructose. The choice of substrate is of course depending on the composition of the oligosaccharide syrup to be produced. The monosaccharide substrate may be passed to the enzyme reactor in essentially pure form, such as 95% monosaccharide on dry substance.

Detailed Description Text (35):
The ratios of the various saccharides in the saccharide solution have been shown to be of great importance for the result of the nanofiltration.

Detailed Description Text (38):
Nanofiltration Step

Detailed Description Text (39):
In the context of the present invention nanofiltration means a membrane separation having a cut-off value of a molecular weight of 300-1,000, for comparison see table 1 with respect to other filtration processes. Monovalent ions can pass fairly freely through a nanofiltration membrane together with water. Polyvalent negative ions are rejected almost completely by a good nanofiltration membrane.

Detailed Description Text (40):
EP 0 452 238 disclose a process for nanofiltering a food processing stream which begins with a starch slurry and ends with a glucose syrup which is 95% dextrose and 5% di- and trisaccharides. After the nanofiltration the material may be considerably more than 99% pure dextrose. The nanofiltration is preferably carried out in a temperature range from 120.degree. F. to 145.degree. F. EP 0 452 238 describes a process of concentrating a monosaccharide (dextrose) in the permeate from the filtration step, and is silent with respect to a process for concentrating higher saccharides than monosaccharides.

Detailed Description Text (41):
The present inventors have found that by conducting nanofiltration in a temperature range of 60.degree. C. to 100.degree. C. it is possible to obtain an oligosaccharide syrup with a low content of undesired monosaccharides. In a preferred embodiment the nanofiltration is operated at a temperature in the range of 63.degree. C. to 90.degree. C., such as from 65.degree. C. to 80.degree. C.

Detailed Description Text (42):
In a preferred embodiment of the invention the nanofiltration step is conducted at essentially the same temperature as the enzyme reaction step thereby obviating the need for heating or cooling the saccharide solution before it enters the nanofiltration step.

Detailed Description Text (43):
Any nanofiltration membrane which is functional at the selected temperature may be used in the present invention. An example of a good nanofiltration membrane is the Desal 5 series, commercially available from Osmonics Desal.

Detailed Description Text (44):
A preferable nanofiltration membrane should have the following characteristics:

Detailed Description Text (47):
The feed stream for the nanofiltration membrane is constituted of the saccharide

solution produced in the enzymatic reaction step. The feed stream is passed by the nanofiltration membrane under a sufficient pressure to separate the monosaccharides from the higher saccharides. Preferably, the pressure is above 10 atm, such as 10 to 30 atm.

Detailed Description Text (48):
In one embodiment of the invention the feed stream is pumped to the nanofiltration membrane whereby the pump creates the pressure differential through the membrane. A reduction valve then controls the pressure.

Detailed Description Text (49):
The nanofiltration step is operated so as to secure an appropriate content of dry matter at the membrane. In case the content of dry matter rises to a critical value the filtration process will diminish reducing the effeciency of the filtration or even stop. Accordingly, it is of importance to monitor the content of dry matter at the membrane and optionally add water to the feed stream. In one embodiment of the invention the nanofiltration step comprises diafiltration whereby water is added to the feed stream. Preferably, the water added corresponds to the amount of permeate.

Detailed Description Text (52):
The syrup is recovered from the nanofiltration unit. The syrup may be evaporated or subjected to reverse osmosis to increase the content of dry substance by eliminating water.

Detailed Description Text (57):
For oligosaccharide syrups for use as low caloric additives it is preferred that as little sucrose as possible is present. Therefore, the enzymatic reaction typically includes hydrolysing the sucrose to monosaccharides before entering the nanofiltration unit.

Detailed Description Text (62):
When leaving the nanofiltration unit the ratio by weight of monosaccharides to total dry substance in the permeate is preferably at least 80%, more preferably at least 90%.

Detailed Description Text (65):
In another embodiment of the invention the method is conducted as a batch method, in two separate processes, an enzymatic reaction process and a nanofiltration process. In a batch method, it is possible to optimize the nanofiltration step independent of the enzymatic reaction, thereby achieving a more efficient nanofiltration.

Detailed Description Text (66):
Furthermore in a preferred embodiment of the present invention, a combination of a continuous and a batch process may be envisaged, in that at least two nanofiltration units are coupled to the enzyme reactor, whereby one nanofiltration unit is used at a time. When this unit has been filled, the saccharide solution from the enzymatic reaction will be directed to the other unit(s). After the filling of the nanofiltration unit the nanofiltration step is then conducted as a batch process. By this combination the advantages from both methods are achieved.

Detailed Description Text (70):
means 4 for passing saccharide solution from the reactor outlet(s) to at least one nanofiltration unit 2,

Detailed Description Text (71):
at least one nanofiltration unit 2 having a nanofiltration membrane dividing the nanofiltration unit into an entrance side having at least one inlet and at least one outlet 3, and an exit side having at least one outlet 5, and having means for controlling the pressure applied to the membrane,

Detailed Description Text (72):
optionally means for recycling material from an outlet 5 of the exit side of the nanofiltration unit 2 to the enzyme reactor 1.

Detailed Description Text (74):

In a batch mode or a combined continuous/batch mode the enzyme reactor 1 may be operated with at least two nanofiltration units 2, each unit being filled and operated at a time. However, operating the system as batch mode is of course also possible with one nanofiltration unit 2 only.

Detailed Description Text (77):
The nanofiltration unit 2 is typically driven with a pump and a pressure release valve or a reduction valve. The pump is driven to produce the pressure differential over the nanofiltration membrane.

Detailed Description Text (78):
The system is fed with a feed stream through the at least one inlet. When the nanofiltration unit 2 is operated as a diafiltration water may directed to the feed stream to the nanofiltration unit 2 or be added to the nanofiltration unit through another inlet 6.

Detailed Description Text (79):
The permeate leaves the nanofiltration unit 2 from the at least one outlet 5 in the exit side. In a preferred embodiment of the system means for reverse osmosis 7 is provided in the permeate stream in the outlet 5 of the nanofiltration unit 2 or downstream the outlet 5 in order to concentrate the content of dry substance in the permeate.

Detailed Description Text (90):
The produced saccharide solution (approximately 2 kg) was membrane filtered using a Desal 5-series, DL, Durasan.TM. nanofiltration membrane from Osmonics Desal (membrane characteristics are given in table 3).

Detailed Description Text (100):
The saccharide solution was membrane filtered using a Desal 5-series, DL, nanofiltration membrane from Osmonics Desal (membrane characteristics are given in table 3 in Example 1). The membrane system was a labcell plate-and-frame testmodule with a total membrane area of 37 cm.sup.2. The filtration was run first varying temperature, then pressure and finally at a lower bulk DS, to illustrate the effect of changing these parameters on filtration performance.

Detailed Description Text (108):
The saccharide solution was membrane filtered using a Desal 5-series, DL, nanofiltration membrane from Osmonics Desal (membrane characteristics are given in table 3 in Example 1). The membrane system was a plate-and-frame module with a total membrane area of 720 cm.sup.2.

Detailed Description Text (116):
The saccharide solution is membrane filtered using a Desal 5-series, DL, nanofiltration membrane from Osmonics Desal (membrane characteristics are given in table 3 in Example 1). The membrane system is a plate-and-frame module with a total membrane area of 720 cm.sup.2. The saccharide solution is diluted to approximately 30% (w/w) DS and the membranefiltration run at 70.degree. C. and a pressure of 30 bar. The process is operated as a diafiltration by continuously adding water to the feed liquid keeping the volume constant. Whenever 500 g or 1000 g of permeate leave the unit the flux is calculated and samples from the bulk and permeate are taken. The samples are analysed at HPLC for determination of the sugar profile and DS is measured.

Detailed Description Paragraph Table (1):
TABLE 1 Typical Membrane Cut-off Values Type of Membrane Separation Cut-off Values (Molecular Weight) Microfiltration 100,000 to 1,000,000 Ultrafiltration 2,000 to 100,000 Nanofiltration 300 to 1,000 Reverse Osmosis Less than 100

Current US Cross Reference Classification (2):
210/651

CLAIMS:

1. A method for producing an oligosaccharide syrup from a glucose-containing

solution comprising:

(a) reverse hydrolysis of a glucose-containing solution with glucoamylase at a temperature in the range of 50.degree. C. to 100.degree. C. to form a solution comprising monosaccharides, disaccharides, trisaccharides and higher saccharides,

(b) nanofiltration of the solution at a temperature in the range of 60.degree. C. to 100.degree. C. to form the oligosaccharide syrup and a permeate, and

(c) recovering the oligosaccharide syrup, wherein the ratio of disaccharide to the total dry substance in the syrup recovered is at least 40%.

13. The method of claim 1, wherein the nanofiltration step comprises diafiltration.

14. The method of claim 1, wherein nanofiltration is operated at a pressure of 10-30 atm.

15. The method of claim 1, wherein nanofiltration is operated at a temperature in the range of 63.degree. C. to 90.degree. C.

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☐ 1. Document ID: US 6329182 B1

L3: Entry 1 of 3 File: USPT Dec 11, 2001

US-PAT-NO: 6329182
DOCUMENT-IDENTIFIER: US 6329182 B1

TITLE: Method of producing oligosaccharide syrups, a system for producing the same and oligosaccharide syrups

DATE-ISSUED: December 11, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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US-CL-CURRENT: 435/96; 127/55, 210/651, 210/652, 210/654, 435/100, 435/95, 435/99

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

☐ 2. Document ID: US 5681728 A

L3: Entry 2 of 3 File: USPT Oct 28, 1997

US-PAT-NO: 5681728
DOCUMENT-IDENTIFIER: US 5681728 A

TITLE: Method and apparatus for the recovery and purification of organic acids

DATE-ISSUED: October 28, 1997

INVENTOR-INFORMATION:

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Miao; Fudu	Louisville	CO		

US-CL-CURRENT: 435/136; 204/519, 204/522, 204/527, 204/530, 204/534, 204/536, 204/537, 204/630, 204/637, 204/638, 210/259, 210/651, 210/654, 435/137, 435/140, 435/800, 562/486, 562/580, 562/589, 562/593

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 3. Document ID: US 5503750 A

L3: Entry 3 of 3 File: USPT Apr 2, 1996

US-PAT-NO: 5503750
DOCUMENT-IDENTIFIER: US 5503750 A

TITLE: Membrane-based process for the recovery of lactic acid by fermentation of carbohydrate substrates containing sugars

DATE-ISSUED: April 2, 1996

INVENTOR-INFORMATION:

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US-CL-CURRENT: 210/641; 210/259, 210/651